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(71) Applicant : NIKKISO CO LTD

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(72) Inventor : SASAHARA SHIGERU
OHARA SUMIO

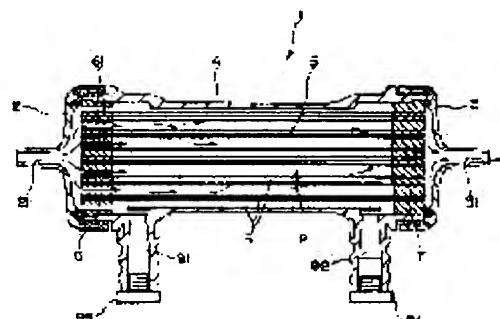
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(54) HOLLOW FIBER TYPE MODULE AND ITS PRODUCTION

(57) Abstract:

PROBLEM TO BE SOLVED: To obtain a hollow fiber module which reduce the occurrence of concn. polarization and has high removal efficiency by adhering and fixing one end of a hollow fiber bundle by a resin compsn., sealing the open ends of the hollow holes of respective hollow fibers and opening and providing a supporting section formed of the resin compsn. with apertures communicating with the outside of the hollow fibers.



SOLUTION: The hollow fiber bundle 5 is housed in a cylindrical casing 4 provided with a closing cap 2 having an injection port 21 for injecting an original liquid to be treated at one end and a closing cap 3 having a discharge port 31 out of which the treated filtrate flows at the other end. The sealing side supporting section 6 for sealing the opening ends of the hollow holes of the respective hollow fibers 51 is formed by adhering and fixing the one end of the hollow fiber bundle 5 at one end of the injection port 21 side in the cylindrical casing 4. The open side supporting section 7 is formed at the other end on the discharge port 31 side in

the cylindrical casing 4 by adhering and fixing the other end of the hollow fiber bundle 5 thereto by the resin compsn. The sealing side supporting section 6 is opened and provided with the apertures 61 for introducing the original liquid by communicating the liquid tight treating space P with the outside.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[The technical field to which invention belongs] This invention relates to the hollow-filament type module used for water treatment, body fluid processing, etc., and its manufacture method.

[0002]

[Description of the Prior Art] As everyone knows, the hollow-filament type module is broadly used considering medical fields, such as a hemodialyzer of the patient who has a disorder in industrial fields, such as concentration of the ultrapure water equipments in semiconductor manufacture, or a solution, and refining, a kidney, or liver, as the start. Conventionally, there is a module which contained and constituted the hollow-filament bunch which closed the end as a kind of this hollow-filament type module in telescopic casing. As this kind of a module, the hollow-filament bunch wrapped in the letter reinforcement object of a network is ****(ed) in telescopic casing, and the thing it was made not to have the need for closure is known by closing an end with a resin constituent or making a hollow-filament bunch curve in the shape of U character.

[0003] However, by these conventional modules, since the other end of a hollow-filament bunch was not being fixed, it was easy to move within telescopic casing, and had become causes, such as thread breakage. Moreover, bending tended to produce the thing made to curve in the shape of U character in each hollow filament, in order to prevent this bending, it needed to bend and the path needed to be enlarged, and large-sized casing which made the diameter of a curvature portion expand was needed after all.

[0004] Then, the end of the hollow-filament bunch which ****(ed) in JP, 7-19550, Y in telescopic casing equipped with the inlet of an undiluted solution, and the exhaust port of transparency liquid It closes, while carrying out adhesion fixation with a resin constituent inside the shape of a ring, and a cap-like sheath. And while pasting up with a resin constituent so that the end of the hollow-filament bunch concerned is fixed to the inside of telescopic casing through the support pillar made to extend from the above-mentioned sheath, and the edge of each hollow filament may turn the other end of this hollow-filament bunch outside and may carry out opening the exhaust port of telescopic casing, and liquid -- the hollow-filament type module fixed densely is proposed

[0005]

[Problem(s) to be Solved by the Invention] However, since an undiluted solution was supplied from the circumference of a hollow-filament bunch and the concentration polarization to which an undiluted solution stops being able to flow easily to the hollow filament for a center section, a solute is accumulated near the hollow filament for a periphery, and solute concentration rises happened when the hollow-filament bunch became large even if it was the improved above-mentioned hollow-filament type module, removal efficiency (filtration efficiency) was falling. Moreover, when the filling factor of a hollow-filament bunch to the bore of telescopic casing became high, the flow of an undiluted solution was barred by the same reason as the above, and removal efficiency was falling according to it.

[0006] this invention was proposed in view of the above, and aims at generating of concentration

polarization offering the few high hollow-filament type module of removal efficiency.

[0007]

[Means for Solving the Problem] Invention indicated to the claim 1 in order to solve the above-mentioned technical problem In the hollow-filament type module which carries out filtration processing of the undiluted solution which closes the end of the hollow-filament bunch with which it filled up in telescopic casing, opens the other end wide, and is supplied in telescopic casing within and without a hollow filament While carrying out adhesion fixation of the end of the hollow-filament bunch with which it filled up in telescopic casing with a resin constituent inside telescopic casing, the open end of the inside hole of each hollow filament is closed. And it is the hollow-filament type module characterized by establishing opening which is open for free passage out of a hollow filament to the supporter formed with the above-mentioned resin constituent.

[0008] Moreover, invention indicated to the claim 2 inserts a hollow-filament bunch into telescopic casing, and the edge of the hollow-filament bunch is set to the manufacture method of the hollow-filament type module fixed to the edge of telescopic casing with a resin constituent, respectively. The hole formation member for forming opening which makes the inside and outside of the supporter formed with the resin constituent concerned open for free passage, when carrying out adhesion fixation of the end of a hollow-filament bunch with a resin constituent While putting in together in the hollow-filament bunch beforehand, pouring in a resin constituent in this state and carrying out adhesion fixation of the end of a hollow-filament bunch, after closing the open end of the inside hole of each hollow filament, It is the manufacture method of the hollow-filament type module characterized by forming opening in a supporter by drawing out the above-mentioned hole formation member from a resin constituent.

[0009]

[Embodiments of the Invention] Hereafter, the gestalt of operation of this invention is explained based on a drawing. the cross section of the hollow-filament type module which drawing 1 requires for this invention, explanatory drawing in which drawing 2 shows the end face by the side of the inlet of an undiluted solution, and drawing 3 -- hole formation -- it is the perspective diagram of a member

[0010] The hollow-filament type module 1 **** and constitutes the hollow-filament bunch 5 inside the telescopic telescopic casing 4 which formed the lock out lid 3 equipped with the exhaust port 31 into which the filtrate processed at one edge in the lock out lid 2 equipped with the inlet 21 which pours in the undiluted solution to process flows in the other-end section. And while carrying out adhesion fixation of the end of the hollow-filament bunch 5, i.e., the end by the side of the inlet 21 of an undiluted solution, with resin constituents, such as a urethane resin, the closure side supporter 6 which closes the opening edge of the inside hole of each hollow filament 51 which constitutes the hollow-filament bunch 5 is formed in the end by the side of the inlet 21 in the telescopic casing 4. On the other hand, although adhesion fixation of the other end of the hollow-filament bunch 5 is carried out with a resin constituent at the other end in the telescopic casing 4 by the side of the exhaust port 31 of the filtered filtrate, the opening side supporter 7 which carries out opening is formed in the outside of a resin constituent, without closing the opening edge of the inside hole of each hollow filament 51.

[0011] In addition, as the above-mentioned hollow filament 51, the hollow fiber of the proper quality of the materials, such as a celluloses system hollow fiber, such as a cellulose acetate, a copper ammonia cellulose, a polyacrylonitrile, trimethyl methacrylate, polyethylene, and polyvinyl alcohol, and a synthetic-macromolecule hollow fiber, can be used. Moreover, as for each hollow filament 51, what is considered as the crimp configuration, respectively is desirable. Thus, outside liquid can make it easy to be able to make positively the internal and external flow of a hollow filament 51 into a turbulent flow, to be able to prevent concentration polarization by this, and to make contact of hollow-filament 51 comrades able to decrease, to be able to secure the crevice between hollow-filament 51 comrades, and to flow even inside the hollow-filament bunch 5 by this, if a crimp is attached to each hollow filament 51.

[0012] the liquid which the telescopic casing 4 and the closure side supporter 6 concerned make to the closure side supporter 6 with which the resin constituent which carries out adhesion fixation forms the hollow-filament bunch 5 in the inlet 21 side of said undiluted solution -- the opening 61 for making the dense processing space P open for free passage with the exterior, and making an undiluted solution

introduce is established

[0013] the position which avoided the hollow filament 51 in order to have established this opening 61 -- hole formation of two or more cylindrical or lines, or a filamentose -- the hole formation above-mentioned after putting in the member 81 together with the hollow-filament bunch 5 beforehand, and a resin constituent's hardening and carrying out adhesion fixation of the hollow-filament bunch 5 -- a member 81 is drawn out and opening 61 is established to the closure side supporter 6 the hole shown in drawing 3 -- formation -- the operation gestalt of a member 81 -- one field of the disk-like substrate 82 -- two or more rods -- hole formation -- it implants as a member 81 and the hole formation unit 8 is constituted in addition, each hole formation of the hole formation unit 8 -- the length of a member 81 is set up for a long time than the thickness of the supporter 6 to form

[0014] the time of inserting the hollow-filament bunch 5 into the telescopic casing 4, as shown in drawing 4 , in order to establish the opening 61 of the closure side supporter 6 using this hole formation unit 8 -- the end side of the hollow-filament bunch 5 -- the hole formation unit 8 -- pressing -- each hole formation -- the member 81 is inserted into the thread 5 And a cap 83 is put and closed to opening of the telescopic casing 4, a resin constituent is poured in from the 1st side mouth 91 which protruded on the circumferential side of the telescopic casing 4 in this state, and while rotating the telescopic casing 4, moving a resin to the edge of the telescopic casing 4 with a centrifugal force, making it harden and carrying out adhesion fixation of the end of each hollow filament 51 of the hollow-filament bunch 5, the open end of the inside hole of each hollow filament is closed. In rotating the telescopic casing 4, moving a resin to an edge and making it harden, a cap 83 side draws radii tracing, and rotates, and it makes it the centrifugal force by this rotation act toward a cap 83 side along with the longitudinal direction of the telescopic casing 4. For example, as shown in drawing 4 , as the center of rotation O intersects perpendicularly, it rotates the center of a simultaneously of the longitudinal direction of the telescopic casing 4. Moreover, when carrying two or more telescopic casing 4 -- on a turntable (not shown) and rotating, where it turned the cap 83 to the periphery veranda of a turntable and an opposite side (the 2nd side mouth 92 side) is turned to the center side of a turntable, you may arrange to a radial. if the hole formation unit 8 is removed while removing a cap 83, if a resin solidifies -- each hole formation from a supporter 6 -- since a member 81 is drawn out, opening 61 is formed in this portion In addition, if few crevices are formed between the substrate 82 of the hole formation unit 8, and the hollow-filament bunch 5, a resin constituent can close the open end of a hollow filament 51 certainly. moreover, hole formation of the hole formation unit 8 -- in order to draw out a member 81 easily from a resin constituent, it is desirable to draw out to the inside of the semi-hardening state before a resin constituent solidifies completely applying removers (release agent), such as silicon, to the front face of the hole formation unit 8 which touches a resin constituent beforehand further again *** -- hole formation -- it will become easy to draw out if the taper whose diameter is reduced toward a nose of cam to a member 81 is attached

[0015] On the other hand, in order to carry out adhesion fixation of the other end of the hollow-filament bunch 5 A cap 84 is put and closed to opening of the telescopic casing 4 as usual. Pour in a resin constituent from the 2nd side mouth 92 which protruded on the circumferential side of the telescopic casing 4 in this state, and like the aforementioned case, rotate the telescopic casing 4, move a resin to the edge of the telescopic casing 4 with a centrifugal force, it is made to solidify, and adhesion fixation of the other end of each hollow filament 51 of the hollow-filament bunch 5 is carried out. And if a resin solidifies, while removing a cap 84, cutting the surplus portion 93 and opening the other end of each hollow filament 51, the opening side supporter 7 is completed. In addition, if a surplus portion is cut, the edge of each hollow filament 51 can be made to open wide certainly, since this resin can prevent permeating into hole in a hollow filament 51 when a resin constituent is poured in, if heating fusion of the other end of the hollow-filament bunch 5 is carried out and the open end of each hollow filament 51 is plugged up beforehand.

[0016] thus, hole formation cylindrical with this operation gestalt -- the resin constituent which puts in the member 81 together with the hollow-filament bunch 5, and was poured in -- semi-hardening -- or -- since it hardens -- hole formation -- although the member 81 was drawn out and opening 61 was

established to the closure side supporter 6 -- hole formation -- a member 81 is not restricted to a cylindrical member for example, the time of inserting the hollow-filament bunch 5 into the telescopic casing 4 -- the inside of the hollow-filament bunch 5 -- thin and long picture wire rods, such as the shape of the shape of a filamentose and a wire, and a string, -- hole formation -- it considers as a member 81 and two or more are put in And a cap 83 is put and closed to opening of the telescopic casing 4, a resin constituent is poured in from the 1st side mouth 91 which protruded on the circumferential side of the telescopic casing 4 in this state, and while rotating the telescopic casing 4, moving a resin to the edge of the telescopic casing 4 with a centrifugal force, making it harden and carrying out adhesion fixation of the end of each hollow filament 51 of the hollow-filament bunch 5, the open end of the inside hole of each hollow filament 51 is closed. if a resin hardens, while removing a cap 83 -- the hole formation made from a wire rod -- opening 61 will be formed in this portion if a member 81 is drawn out from a supporter 6 in addition, the hole formation made from a wire rod -- the time of drawing out, if the member 81 is made longer than a hollow filament 51 and this long surplus portion is made to project from the edge of the opposite side (exhaust port side) of the hollow-filament bunch 5 -- this protrusion -- it is easy to draw out to an opposite side with a portion the bottom

[0017] as [described / since there was a possibility might attach a blemish to a hollow filament 51 accidentally / although the method of making a hole was also in the closure side supporter 6 which is a needlelike thing and the resin constituent concerned forms after carrying out adhesion fixation of the hollow-filament bunch 5 with a resin constituent, in order to establish the above openings 61 to the closure side supporter 6 / above] -- beforehand -- hole formation -- a member 81 puts in in the hollow-filament bunch 5, and the method of removing behind is In addition, the 1st of the tubed casing 4 and the 2nd side mouths 91 and 92 seal one side or both by the blind cover 94 if needed, after forming supporters 6 and 7.

[0018] The above hollow-filament type modules 1 of composition pressurize and pour in the raw material water for manufacturing for example, industrial ultrapure water as an undiluted solution from the inlet 21 formed in the lock out lid 2 formed in the end of the telescopic casing 4. The raw material water poured in into the inlet 21 flows into the processing space P which the telescopic casing 4, the closure side supporter 6, and the opening side supporter 7 form through the opening 61 established to the closure side supporter 6 which consists of a resin constituent. In this processing space P, raw material water contacts the peripheral face of a hollow filament 51. Although water penetrates the wall surface of a hollow filament 51 and reaches to the inside hole of a hollow filament 51 at this time, an impurity is left behind to the processing space P, without the ability passing. and the filtrate which the impurity was removed and became pure water -- hollow -- it flows out of the exhaust port 31 of the other end through a hole In addition, it leaves without the concentration of a raw material underwater impurity being high, or sealing the 1st or 2nd side mouth 91 and 92, when there is much processing volume, and a throughput can be improved by making concentration liquid discharge from this side mouth. In this case, it is desirable to constitute so that back pressure grant meanses, such as a throttle valve, may be prepared in the downstream of a side mouth which makes concentration liquid discharge and the pressure in casing 4 can be held by drawing resistance of this throttle valve.

[0019] Since it is supplied from various arbitrary positions of the hollow-filament bunch 5 while an undiluted solution is supplied along with the longitudinal direction of the hollow-filament bunch 5 in parallel by the hollow-filament type module 1 concerning this invention to the hollow-filament bunch 5 at this time, concentration polarization cannot happen easily and efficient filtration is possible. Moreover, even if it faces connection with an external instrument, connection is linearly possible, without using communication trunks, such as an elbow, and it is not necessary to bend piping. Therefore, flow resistance can be decreased, and complication-ization of the pipe line can be prevented, easy-ization of a maintenance can be attained, and the miniaturization of equipment can be attained by miniaturization of the pipe line. Furthermore, the direction of a hollow filament 51 and the flow direction of an undiluted solution are the same directions, and it is rare to become possible to flush the impurity which stops at the front face of a hollow filament 51 by the flow of this undiluted solution, and to cause the increase in a filtration resistance.

[0020] On the other hand, since the closure side supporter 6 and the opening side supporter 7 are formed in this invention by carrying out adhesion fixation of the hollow-filament bunch 5 with a resin constituent into the telescopic casing 4, a pressure resistance can be raised, the pressurization to an undiluted solution is set up highly, and shortening of filtration time is possible.

[0021] As mentioned above, although this invention was explained about the operation gestalt of a drawing, this invention is not limited to the above-mentioned gestalt of operation, and unless the composition indicated to the claim is changed, it can be carried out suitably. For example, with said gestalt of operation, although filtration processing is carried out from the outside of a hollow filament through the undiluted solution to the inside, from the inside of a hollow filament, an undiluted solution may be turned outside, and it may let it pass, and it may be processed. In this case, the exhaust port 31 of the opening-and-closing lid 3 functions as an inlet of an undiluted solution, and the inlet 21 of the opening-and-closing lid 2 functions as an exhaust port.

[0022] Moreover, not only filtration of water but by choosing a filtration membrane suitably, the hollow-filament type module 1 concerning this invention is applicable also to freshening of seawater, and applicable also to filtration processing of body fluid etc. and separation processing. For example, it can use also for removal of the virus in an injection, dialysing fluid, plasma, etc., an endotoxin, etc. Since the telescopic casing 4 is equipped with the 1st and the 2nd side mouths 91 and 92 with the aforementioned operation gestalt further again, if blood is supplied from an input 21 where the 1st side mouth 91 is blockaded, suction eccrisis will be carried out from the exhaust port 31 on which the plasma which penetrates a hollow filament functions as a plasma exhaust port by the roller pump etc., and the condensed blood will be discharged from the 2nd side mouth 92 which functions as a plasma exhaust port.

[0023]

[Effect of the Invention] The hollow-filament type module applied to this invention as explained above While carrying out adhesion fixation of the end of the hollow-filament bunch with which it filled up in telescopic casing with a resin constituent inside telescopic casing, the open end of the inside hole of each hollow filament is closed. and since opening which is formed with the above-mentioned resin constituent and is open for free passage out of a hollow filament to a supporter was formed, from this opening, it can supply that there is no nonuniformity in a hollow-filament bunch, and an undiluted solution is looked like [a part for the core of a hollow-filament bunch as well as a part for a periphery], and can be supplied to it Therefore, filtration with it is possible, and when removal efficiency can be raised remarkably and the filling factor of a hollow-filament bunch to the bore of telescopic casing is especially made high, improvement in removal efficiency is remarkable. [there is little concentration polarization and efficient] Moreover, this invention can offer the compact hollow-filament type module which obtains a high pressure resistance and which can carry out things and does not need telescopic casing of a big path. Furthermore, since an undiluted solution is not only processed linearly, but can connect linearly to a piping line within casing, an undiluted solution always flows linearly and there is no decline in removal efficiency. And the miniaturization of the whole equipment is also as possible as the miniaturization of the module itself conjointly.

[0024] Moreover, according to the manufacture method of this invention, the above highly efficient and practical hollow-filament type modules can be manufactured easily without a possibility of damaging a hollow filament.

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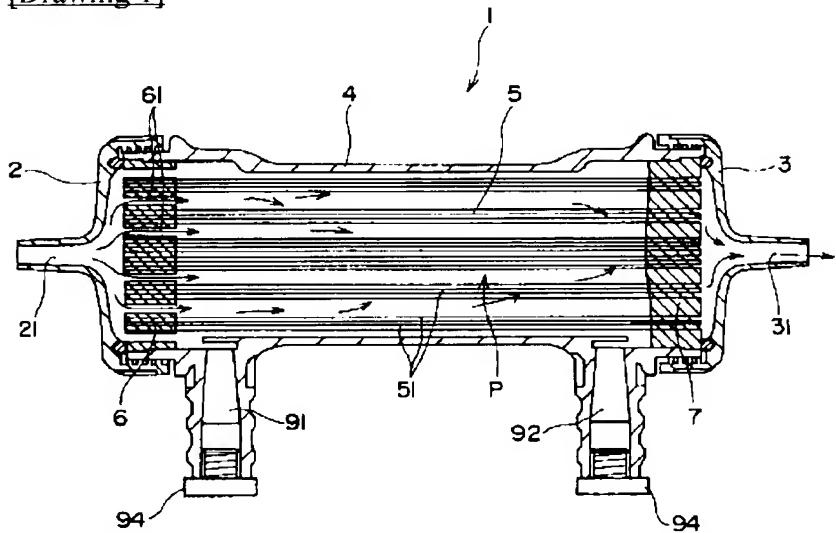
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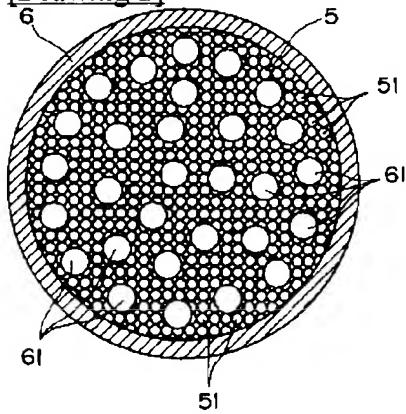
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DRAWINGS

[Drawing 1]



[Drawing 2]

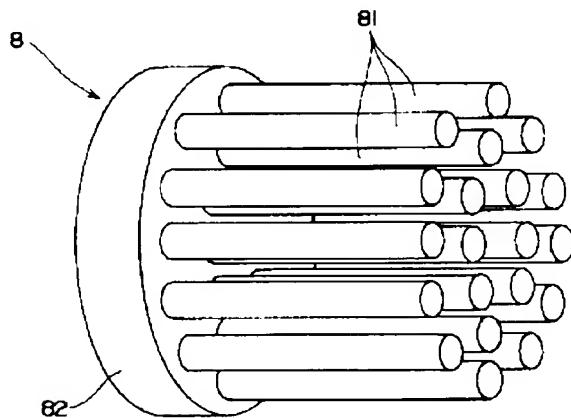


[Drawing 3]

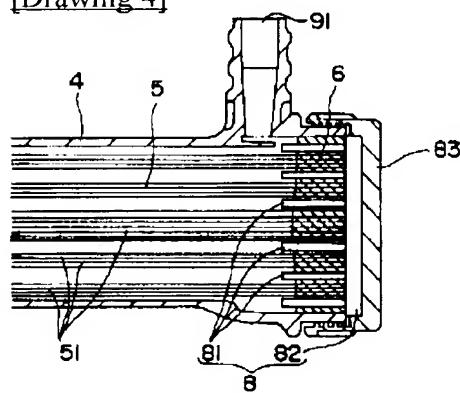
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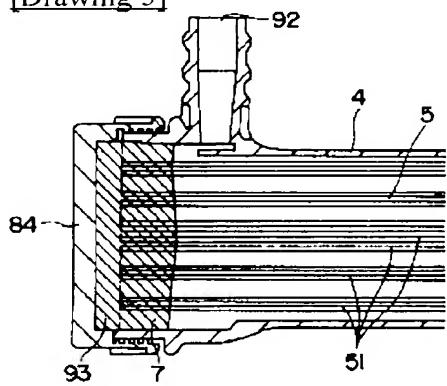
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[Drawing 4]



[Drawing 5]



[Translation done.]